

Attorney Docket No. 82995
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UNDERWATER WEAPON SYSTEM HAVING A ROTATABLE GUN

TO ALL WHOM IT MAY CONCERN

BE IT KNOWN THAT THOMAS J. GIESEKE, citizen of the United States of America, employee of the United States Government and resident of Newport, County of Newport, State of Rhode Island has invented certain new and useful improvements entitled as set forth above of which the following is a specification:

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3 UNDERWATER WEAPON SYSTEM HAVING A ROTATABLE GUN

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5 STATEMENT OF GOVERNMENT INTEREST

6 The invention described herein may be manufactured and used
7 by or for the Government of the United States of America for
8 Governmental purposes without the payment of any royalties
9 thereon or therefore.

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11 BACKGROUND OF THE INVENTION

12 (1) Field of the Invention

13 The present invention relates generally to underwater
14 weapons systems, and more particularly to an underwater weapon
15 system having a rotating gun system mounted in a vehicle housing.

16 (2) Description of the Prior Art

17 Underwater gun systems are being developed for use as anti-
18 mine and anti-torpedo applications. The basic systems include an
19 underwater gun, underwater projectiles, a ship-mounted turret
20 supporting the underwater gun, a targeting system and a combat
21 system. The underwater gun shoots the underwater projectiles
22 which are specially designed for neutralization of undersea
23 targets at ranges of 200 meters or more. The undersea targets
24 are identified and localized with the targeting system, and the
25 combat system provides the control commands to direct the ship-
26 mounted turret to aim the gun towards the target.

1 Currently, underwater gun systems are mounted onboard a
2 conventional ship by means of a retractable gun turret that
3 deploys a rotating gun using a large hydraulic actuator. The gun
4 is stored in a bay having a hatch on the bottom of the ship that
5 can be opened to allow the turret and gun to be deployed
6 therethrough. When deployed, the gun turret is not readily
7 faired thereby causing drag that results in substantial
8 hydrodynamic loads on the deployed turret and the host ship.
9 Furthermore, for the gun system to respond in a rapid fashion to
10 an unexpected threat, the gun system must be continuously
11 deployed thereby subjecting the host ship to long-term
12 hydrodynamic loads while also reducing the value of having a
13 retractable system. Still further, the space required onboard
14 the host ship is considerable, e.g., the length required for a
15 retractable turret can exceed ten meters for a gun that fires 30
16 millimeter caliber rounds.

SUMMARY OF THE INVENTION

19 Accordingly, it is a general purpose and primary object of
20 the present invention to provide an underwater weapon system that
21 can be continuously deployed without substantially impacting the
22 operation of a ship that the weapon system is tasked to protect.

23 It is a further object of the present invention to provide
24 an underwater weapon system that can be maneuvered to engage an
25 underwater target in any direction relative thereto.

1 Other objects and advantages of the present invention will
2 become more obvious hereinafter in the specification and
3 drawings.

4 To obtain the objects described, an underwater weapon system
5 having a vehicle housing is defined by a first portion and a
6 second portion spaced apart from one another. Each vehicle
7 housing portion has an exterior configured to provide
8 hydrodynamic position control. The first and second vehicle
9 housing portions are used cooperatively to alter a position of
10 the vehicle housing in the water as the vehicle housing moves
11 therethrough (e.g., via towing or attached propulsors).

12 A gun system is rotatably mounted to and between the first
13 and second vehicle housing portions at an axis of rotation. The
14 gun system includes a gun and ammunition sealed within a
15 waterproof housing with a muzzle of the gun protruding from the
16 waterproof housing. As a result, the muzzle can discharge
17 ammunition therefrom into the water between the first and second
18 vehicle housing portions. The gun system is also rotatable
19 relative to the first and second vehicle housing portions to a
20 position where the muzzle is positioned to fire ammunition
21 towards an underwater target.

23 BRIEF DESCRIPTION OF THE DRAWINGS

24 Other objects, features and advantages of the present
25 invention will become apparent upon reference to the following
26 description of the preferred embodiments and to the drawings,

1 wherein corresponding reference characters indicate corresponding
2 parts throughout the several views of the drawings and wherein:

3 FIG. 1 is a perspective view of a towable underwater weapon
4 system in accordance with one embodiment of the present
5 invention;

6 FIG. 2 is a partial plan view of the towable underwater
7 weapon system with the view taken from the reference line 1-1 of
8 FIG. 1 and a portion of the waterproof housing removed for
9 clarification purposes;

10 FIG. 3 is a block diagram of the functional elements of the
11 towable underwater weapon system; and

12 FIG. 4 is a partial plan view of a self-propelled underwater
13 weapon system in accordance with another embodiment of the
14 present invention with a portion of the waterproof housing
15 removed for clarification purposes.

16

17 DESCRIPTION OF THE PREFERRED EMBODIMENT(S)

18 Referring now to the drawings, simultaneous reference will
19 be made to FIGs. 1 and 2 wherein one embodiment of an underwater
20 weapon system in accordance with the present invention is shown
21 and is referred generally by numeral 10. As explained below, the
22 underwater weapon system 10 is a towable system designed to be
23 pulled behind a host vessel (not shown). However, as will also be
24 explained below, the present invention can be implemented as a
25 self-propelled system and is not limited to use as a towed
26 system.

1 The underwater weapon system 10 has first and second housing
2 portions 12 and 14 that can be mated to form a vehicle housing
3 that can be maneuvered through the water. The housing portions
4 12 and 14 are separated from one another and have a gun system 16
5 coupled thereto and therebetween such that the gun system 16 is
6 rotatable relative to the housing portions 12 and 14 about an
7 axis of rotation 18 defined by dashed line. More specifically,
8 the gun system 16 is coupled to each of housing portions 12 and
9 14 by a hub 20 that will typically be motorized to permit
10 controlled rotation of the gun system.

11 The gun system 16 has a waterproof housing 160 that encases
12 an underwater gun 162 with a length of a muzzle 163 extending
13 from the waterproof housing 160. The waterproof housing 160 also
14 encases ammunition 164 for the underwater gun 162. It is to be
15 understood that the ammunition 164 includes both the stowage of
16 the ammunition (i.e., a magazine) and a supplying structure for
17 the ammunition (i.e., a feed system) to the gun 162. Such a gun
18 magazine and feed systems are well known in the art and will,
19 therefore, not be described further herein.

20 The underwater gun 162 includes the muzzle 163 that
21 protrudes from the waterproof housing 160 with the muzzle
22 encompassing a bore axis 165. Thus, the gun system 16 rotating
23 about the hub 20 provides for the rotation of the muzzle 163/bore
24 axis 165. The underwater gun 162 can be positioned such that its
25 bore axis 165 is aligned with the axis of rotation 18 of the gun
26 system 16. However, in some situations, it may be desirable to

1 have the bore axis 165 offset from the axis of rotation 18. In
2 either case, the gun system 16 is rotatable about the hub 20 to a
3 position that points the bore axis 165 towards an underwater
4 target.

5 The gun system 16 can be rotated in its plane of rotation
6 depicted by dashed line 22. However, to fire at targets out of
7 plane 22, the underwater weapon system 10 must be able to rotate
8 itself through the plane 22 as indicated by two-headed
9 directional arrow 24. Such a rotation of the underwater weapon
10 system 10 is made possible by the combination of: (i) wings 120
11 and 140 extending out, respectively, from the housing portions 12
12 and 14, and (ii) movable control surfaces 122 and 142 extending
13 out, respectively, from the housing portions. The particular
14 shape, size and number of wings 120/140 and control surfaces
15 122/142 can be varied without departing from the scope of the
16 present invention.

17 In operation, as the underwater weapon system 10 moves
18 through the water, the control surfaces 122/142 and wings 120/140
19 cooperate to allow the underwater weapon system 10 to rotate
20 through plane 22.

21 In addition, the shape of the housing portions 12 and 14 can
22 be configured to contribute to the maneuverability of the
23 underwater weapon system 10. For example, each of the housing
24 portions 12 and 14 can themselves define wings that are
25 transverse to the wings 120 and 140. Furthermore, the housing
26 portions 12 and 14 can be formed as mirror-images relative to the

1 plane 22 so that a hydrodynamically balanced vehicle housing is
2 defined thereby.

3 With the gun system 16 able to rotate about the hub 20 while
4 the underwater weapon system 10 is able to rotate through the
5 plane 22, the gun 162 can engage targets at any spherical
6 position relative to the underwater weapon system.

7 In terms of the towed embodiment depicted in FIGs. 1 and 2,
8 a swiveling tow couple 30 is mounted to underwater weapon system
9 10. The tow couple 30 provides a point of attachment for a tow
10 cable 100 (e.g., a strength and, if needed, a signal/power
11 carrying cable) coupled to a host ship (not shown) while
12 simultaneously allowing the underwater weapon system 10 to freely
13 rotate through the plane 22. Accordingly, the tow couple 30
14 includes a frame 32 attached partially to each of the housing
15 portions 12 and 14, and a swivel 34 rotatably coupled to the
16 frame 32 by coupling means such as a pin 36. The swivel 34 is
17 aligned such that its axis of rotation is coincident with the
18 plane 22.

19 While the wings 120 and 140 contribute to the hydrodynamic
20 maneuverability of the underwater weapon system 10, the wings can
21 also be configured to provide support platforms for sensors used
22 by targeting and/or combat systems that can be included onboard
23 the underwater weapon system. For example, in the illustrated
24 embodiment, each of the wings 120 and 140 can be V-shaped with:
25 (i) forward-facing surfaces 120A/140A disposed at a substantially
26 forward facing angle relative to the plane 22, and (ii) rearward-

1 facing surfaces 120B/140B disposed at a substantially rearward
2 facing angle relative to the plane 22. Active or passive sonar
3 arrays (not shown in FIGs. 1 and 2 for clarity of illustration)
4 can be placed on each of the surfaces 120A/120B and 140A/140B,
5 respectively, thereby forming forward and aft looking sonar on
6 both sides of the underwater weapon system 10.

7 Referring now to FIG. 3 for the operation of the underwater
8 weapon system 10, the outputs from sonar arrays 124 and 144
9 (mounted on surfaces 120A, 120B, 140A and 140B) are supplied to
10 an on-board processor 40 for target identification and
11 localization. Such processing is well understood in the art and
12 will, therefore, not be addressed further herein.

13 Once a target has been identified/localized, the processor
14 40 sends control signals to the movable control surfaces 122 and
15 142. In this way, the housing portions 12 and 14 can rotate
16 through the plane 22 to a desired position as they are towed
17 through the water. At the same time, the processor 40 sends
18 control signals to the motorized hub 20 in order to rotate it
19 about the axis 18 until the muzzle 163/bore axis 165 achieves a
20 desired aim point. Once the gun 162 is aimed, the magazine 164A
21 and feed system 164B of the ammunition 164 supply underwater
22 projectiles to the gun 162.

23 As mentioned above, the present invention is not limited to
24 use as a towable vehicle. Accordingly, FIG. 4 illustrates
25 another embodiment of the present invention in which propulsors
26 50 are coupled to each of the vehicle housing portions 12 and 14.

1 The number of propulsors used and their positioning relative to
2 the vehicle housing portions 12 and 14 are not limitations of the
3 present invention. It is noted that the tow couple 30 (FIGs. 1
4 and 2) can be eliminated in this embodiment of the present
5 invention.

6 The advantages of the present invention are numerous. The
7 underwater weapon system integrates a continuously-deployed
8 underwater gun into a towable or self-propelled platform that can
9 be maneuvered such that the gun can be aimed at any target in a
10 spherical region about the gun. This provides a host ship with
11 "on demand" protection without impacting the host ship's
12 hydrodynamics.

13 It will be understood that many additional changes in the
14 details, materials, steps and arrangement of parts, which have
15 been herein described and illustrated in order to explain the
16 nature of the invention, may be made by those skilled in the art
17 within the principle and scope of the invention as expressed in
18 the appended claims.